Reminder:
- If you are asked to find something that is a vector, such as velocity, displacement, acceleration, you must express your answer in vector form unless you are specifically asked to find a scalar component.
- It is not permissible to have any physics information (constants, equations, etc.) stored in your calculator. On the test, you will be asked to sign the statement, "I understand this principle and am abiding by it."

Come and show me after every lettered part of every problem.

1. Marty takes a walk: He first walks 10 m to his right, then turns right and walks another 6 meters, and then turns right again and walks 2 m.
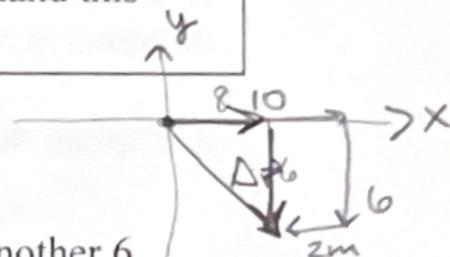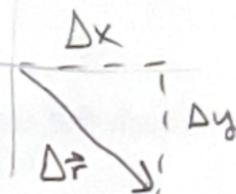
a. Sketch the displacement vector for Marty's walk. Set up a coordinate system on your sketch. Write his displacement:

$$\Delta \vec{r} = (10 \text{ m}, -36°)$$

BRAVO

b. Draw the x and y vector components of Marty's displacement on your picture. Write the y-vector component of Marty's displacement:

$$(\Delta \vec{r})_y = (6 \text{ m}, 270°)$$

c. Draw the x and y scalar components of Marty's displacement here:

Write the y-scalar component of Marty's displacement: $\Delta y = -6 \text{ m}$

2. If Marty took 2 minutes for his walk,

a. determine his average speed. Justify with a fact.

Average speed is path length divided by time.

$$S = \frac{10 + 6 + 2}{\Delta t} = \frac{18}{2 \text{ min}} = \boxed{9 \text{ m/min}}$$

b. determine his average velocity. Justify with a fact.

Average velocity is displacement divided by time.

$$\vec{V}_{avg} = \frac{\Delta \vec{r}}{\Delta t} = \frac{(10\text{m}, -36°)}{2\text{min}} = (5 \text{ m/min}, -36°)$$

3. The basic definition of displacement is change in __position__ (which is called ~~displacement~~ ~~every~~ ~~unit of time~~

The basic definition of velocity is change in __position__ every __unit of time__

The basic definition of acceleration is change in __velocity__ every __unit of time__

4. An object is moving in the negative direction and speeding up at a rate of 3 m/s every second

What is the object's acceleration? (3 m/s², negative direction)←
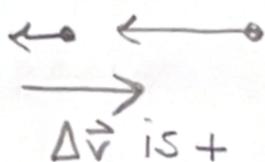
What is the object's x-scalar component of the acceleration? − 3 m/s²

5. The y-scalar component of the acceleration of a hot air balloon moving in the negative direction is + 3 m/s².

a. Explain this acceleration in words.

The velocity changes by +3 m/s in every second
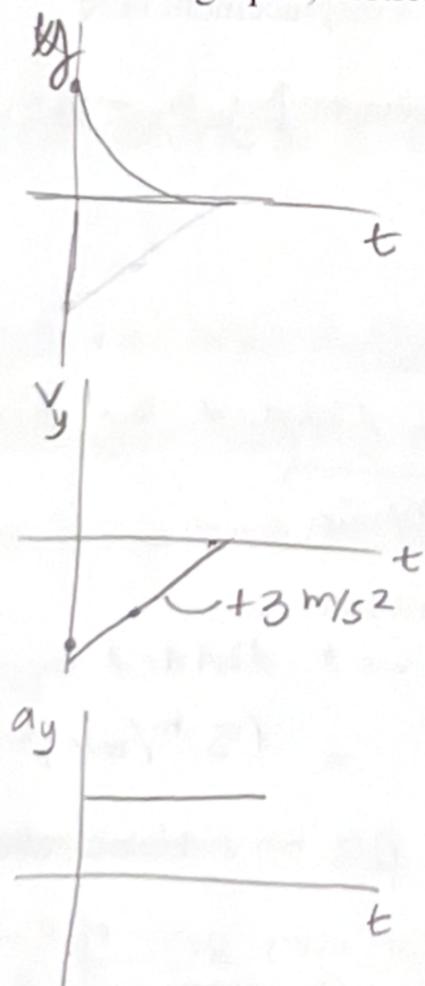
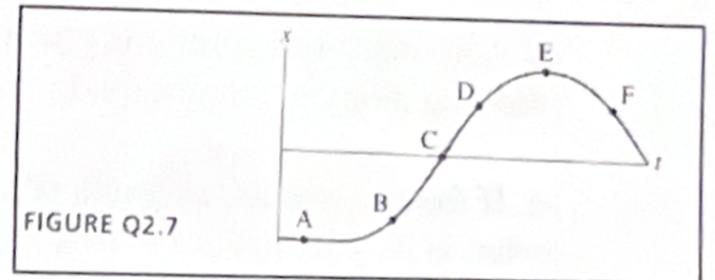b. Is the balloon speeding up or slowing down? Support your answer.

It is slowing down. The velocity is becoming more +, for example −12 m/s, − 9 m/s, − 6 m/s.

Δv⃗ is +

c. Sketch the motion diagram

d. Sketch the three motion graphs, vertically stacked:

+3 m/s²

6. Figure 2.7 shows the position-time graph for a moving object.

- Be prepared to verbally justify each answer with a fact. At which lettered point or points:

  a. Is the object moving the fastest? __C__

  b. Is the object moving to the left? __F__

  c. Is the object speeding up? __B, F__

  d. Is the object turning around? __E__

  e. Is the object moving with a constant velocity? __maybe C__

  f. Is the object remaining at rest? __A__

- Sketch a motion diagram for the object.

FIGURE Q2.7
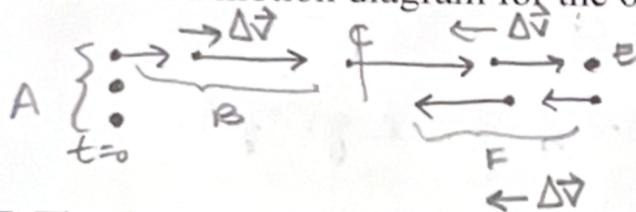
7. The velocity-time graph is given for a boat on a lake, moving in a straight line.
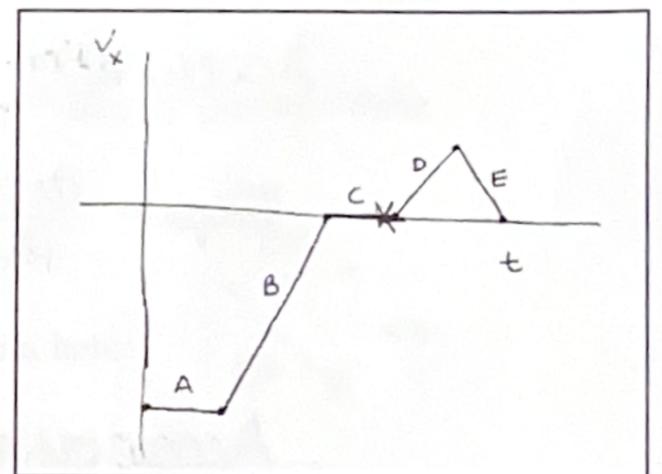
- Be prepared to verbally justify each answer with a fact During which lettered time interval(s) is the boat...

  a. remaining at rest? __C__

  b. moving with constant velocity? __A__

  c. moving with fastest speed? __A__

  d. moving in the negative direction? __A, B__

  e. decreasing speed? __B, E__

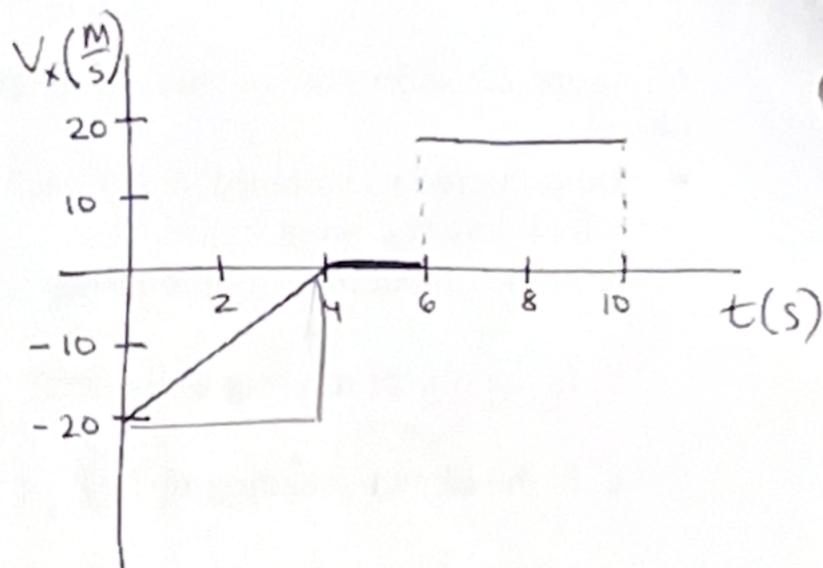 f. moving with positive, constant (non-zero) acceleration? __B, D.__

- Does the boat ever change direction? __yes__ If so, mark when this happens with a * on the graph.

- Sketch a motion diagram for the boat.

$\vec{\Delta v}$ is + $\vec{\Delta v}$ is −
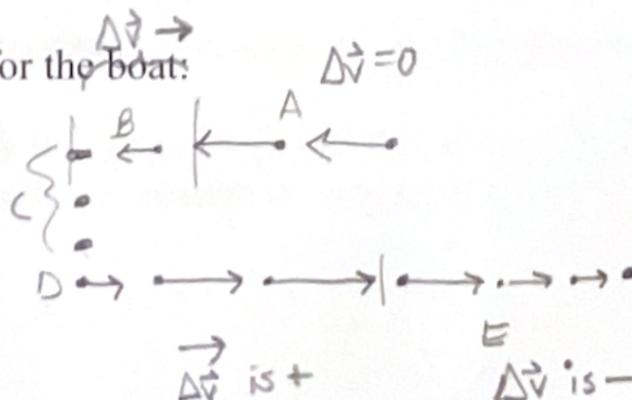
8. A velocity-time graph is given for an car moving along a straight road.

a. If the car was initially at a position of -2.0 m, what is its position at t = 10 s? Justify with a fact.

Area of a velocity-time graph is displacement.

$$\text{Area} = \frac{1}{2}bh + b_2h_2$$

$$= \frac{1}{2}(4s)(-20\,m/s) + (4s)(20\,m/s) = -40m + 80m = 40m$$

Its position at t=10s is 40m + -2m = $\boxed{38m}$

b. Sketch the motion diagram and position-time graph and acceleration-time graph for this motion

b. What is acceleration from 0 to 4?

Acceleration is the slope of a velocity-time graph.

$$\text{Slope} = \frac{\text{Rise}}{\text{Run}} = \frac{+20\,m/s}{4s} = +5\,m/s^2 \longleftarrow \text{this is the x-scalar component of acceleration}$$

Acceleration is a vector, so $\boxed{\vec{a} = (5\,m/s^2, +x\text{-direction})}$

9. Complete Activity 4 on "Analyzing Free Fall Motion"

10. Complete Activity 6 on "Analyzing Free Fall Motion"

11. Complete Activity 7 on "Analyzing Free Fall Motion"